imall

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74HC595

8-BIT SHIFT REGISTER WITH 8-BIT OUTPUT REGISTER

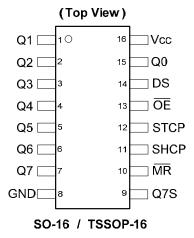
Description

The 74HC595 is an high speed CMOS device.

An eight bit shift register accpets data from the serial input (DS) on each positive transition of the shift register clock (STCP). When asserted low the reset function ($\overline{\text{MR}}$) sets all shift register values to zero and is indepent of all clocks.

Data from the input serial shift register is placed in the output register with a rising pulse on the storages resister clock (SHCP). With the output enable (\overline{OE}) asserted low the 3-state outputs Q0-Q7 become active and present th

All registers capture data on rising edge and change output on the falling edge. If both clocks are connected together the input shift register is always one clock cycle ahead of the output register.



Features

- Wide Supply Voltage Range from 2.0V to 6.0V
- Sinks or sources 8mA at V_{CC} = 4.5V
- CMOS low power consumption
- Schmitt Trigger Action at All Inputs
- Inputs accept up to 6.0V
- ESD Protection Tested per JESD 22
 - Exceeds 200-V Machine Model (A115-A)
 - Exceeds 2000-V Human Body Model (A114-A)
 - Exceeds 1000-V Charged Device Model (C101C)
- Latch-Up Exceeds 250mA per JESD 78, Class II
- Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)
- Halogen and Antimony Free. "Green" Device (Note 3)

Applications

General Purpose Logic

Pin Assignments

- Serial to Parallel Data conversion
- Capture and hold data for extended periods of time.
- Allow simple serial bit streams from a microcontroller to control as many peripheral lines as needed.
- Wide array of products such as:
 - Computer peripherals
 - Appliances
 - Industrial control

Notes: 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.

2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.

3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

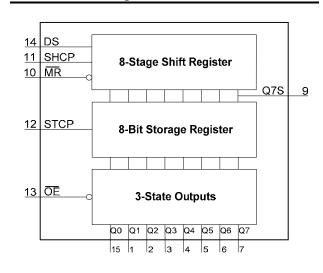
Click here for ordering information, located at the end of datasheet



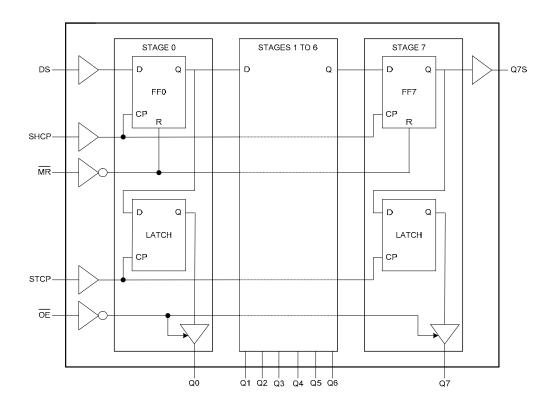
Pin Descriptions

Pin Number	Pin Name	Function				
1	Q1	Parallel Data Output 1				
2	Q2	Parallel Data Output 2				
3	Q3	Parallel Data Output 3				
4	Q4	Parallel Data Output 4				
5	Q5	Parallel Data Output 5				
6	Q6	Parallel Data Output 6				
7	Q7	Parallel Data Output 7				
8	GND	Ground				
9	Q7S	Serial Data Output				
10	MR	Master Reset Input				
11	SHCP	Shift Register Clock Input				
12	STCP	Storage Register Clock Input				
13	OE	Output Enable Input				
14	DS	Serial Data Input				
15	Q0	Parallel Data Output 0				
16	Vcc	Supply Voltage				

Functional Diagram



Logic Diagram

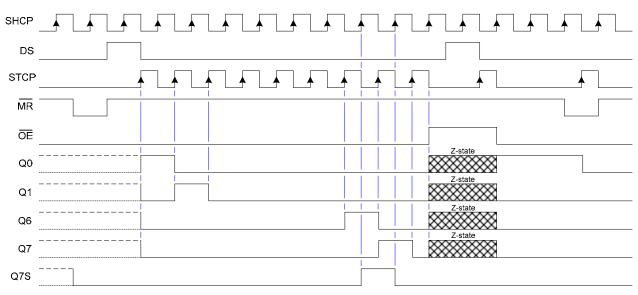




Functional Description and Timing Diagram

	Cor	ntrol		Input	Output		Evention
SHCP	STCP	OE	MR	DS	Q7S	Qn	Function
х	х	L	L	-	L NC		Low-level asserted on MR clears shift register. Storage register is unchanged
Х	1	L	L	-	L	L	Empty shift register transferred to storage register
Х	Х	Н	L	-	L Z		Shift register remains clear;: All Q ouputs in Z state.
¢	x	L	н	_	Q6S	NC	HIGH is shifted into first stage of Shift Register Contents of each register shifted to next register The content of Q6S has been shifted to Q7S and now appears on device pin Q7S
х	\uparrow	L	Н	_	NC	QnS	Contents of shift register copied to storage register. With output now in active state the storage resister contents appear on Q outputs.
\uparrow	\uparrow	L	Н	-	Q6S	QnS	Contents of shift register copied to output register then shift register shifted.

H=HIGH voltage state L=LOW voltage state ↑=LOW to HIGH transition X= don't care – high or low (not floating) NC= No change Z= high-impedance state





Symbol	Des	Rating	Unit	
ESD HBM	Human Body Model ESD Protection	on	2	kV
ESD CDM	Charged Device Model ESD Prote	ction	1	kV
ESD MM	Machine Model ESD Protection		200	V
V _{CC}	Supply Voltage Range		-0.5 to +7.0	V
VI	Input Voltage Range		-0.5 to +7.0	V
Vo	Voltage applied to output in high of	or low state	-0.3 to V _{CC} +0.5	V
I _{IK}	Input Clamp Current VI < -0.5V		-20	mA
I _{IK}	Input Clamp Current VI > Vcc +	Input Clamp Current VI > Vcc +0.5V		
I _{OK}	Output Clamp Current V _O <-0.5V	1	-20	mA
I _{OK}	Output Clamp Current $V_O > V_{CC}$	+0.5V	20	mA
1		Q7 standard output	±25	mA
lo	Continuous output current	Qn bus driver outputs	±35	mA
Icc	Continuous current through Vdd or	r GND	70	mA
I _{GND}	Continuous current through Vdd or	Continuous current through Vdd or GND		mA
TJ	Operating Junction Temperature		-40 to +150	°C
T _{STG}	Storage Temperature	Storage Temperature		°C
P _{TOT}	Total Power Dissipation	500	mW	

Absolute Maximum Ratings (Note 4) (@T_A = +25°C, unless otherwise specified.)

Note: 4. Stresses beyond the absolute maximum may result in immediate failure or reduced reliability. These are stress values and device operation should be within recommend values.

Recommended Operating Conditions (Note 5) (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	Supply Voltage	-	2.0	6.0	V
VI	Input Voltage	-	0	V _{CC}	V
Vo	Output Voltage	Active Mode	0	V _{CC}	V
		V _{CC} = 2.0V	-	1000	~~ //
$\Delta t / \Delta V$	Input transition rise or fall rate	$V_{CC} = 4.5V$	-	500	ns/V
		$V_{CC} = 6.0V$	-	400	-
T _A	Operating free-air temperature	-	-40	+125	°C

Note: 5. Unused inputs should be held at V_{CC} or Ground.



			.,	т	A = +25°C		T _A = -40°C	to +85°C	T _A = -40°C	to +125°C		
Symbol	Symbol Parameter	ol Parameter	Test Conditions	V _{CC}	Min	Тур	Max	Min	Max	Min	Max	Uni
		-	2.0V	1.5	1.2	-	1.5	-	1.5	-		
VIH	High-Level Input Voltage	-	4.5V	3.15	2.4	-	3.15	-	3.15	-	V	
	input voitage	-	6.0V	4.2	3.2	-	4.2	-	4.2	-		
		-	2.0V	-	0.8	0.5	-	0.5	-	0.5		
VIL	Low-Level Input Voltage	-	4.5V	-	2.1	1.35	-	1.35	-	1.35	V	
	input voitage	-	6.0V	-	2.8	1.8	-	1.8	-	1.8		
	High-Level		2.0V	1.9	2.0	-	1.9	-	1.9	-		
	Output	I _{OH} = -20μA	4.5V	4.4	4.5	-	4.4	-	4.4	-		
	Voltage	All outputs	6.0V	5.9	6.0	-	5.9	-	5.9	-		
V_{OH}	07	I _{OH} = -4.0mA	4.5V	3.84	4.32	_	4.32	-	3.7	_	v	
	Q7 output Qn Bus Outputs	I _{OH} = -5.2mA	6.0V	5.34	5.81	_	5.81	-	5.2	-		
		I _{OH} = -6.0mA	4.5V	3.84	4.32	-	4.32	-	3.7	-		
		I _{OH} = -7.8mA	6.0V	5.34	5.81	-	5.81	-	5.2	-		
	Low-Level		2.0V	-	0	0.1	-	0.1	-	0.1		
	Output	I _{OL} = 20µA All outputs	4.5V	-	0	0.1	-	0.1	-	0.1		
	Voltage	All outputs	6.0V	-	0	0.1	-	0.1	-	0.1		
Vol	07	$I_{OL} = 4.0 \text{mA}$	4.5V	-	.15	0.33	-	0.33	_	0.4	V	
	Q7 output	I _{OL} = 5.2mA	6.0V	-	.16	0.33	-	0.33	-	0.4		
	Qn Bus	$I_{OL} = 6.0 \text{mA}$	4.5V	_	.15	0.33	-	0.33	-	0.4		
	Outputs	I _{OL} = 7.8mA	6.0V	-	.16	0.33	-	0.33	-	0.4		
I _I	Input Current	V _I =GND to 5.5V	6.0V	_	-	±0.1	-	± 1	-	± 1	μA	
loz	OFF-state output current	Qn internal high or low Vo = Vcc or Gnd	6.0V	_	_	± 5	_	± 5	_	± 10	μA	
I _{CC}	Supply Current	$V_{I} = GND \text{ or } V_{CC}$ $I_{O} = 0$	6.0V	-	_	8.0	_	80	_	160	μA	
Ci	Input Capacitance	$V_i = V_{CC}$ or GND	6.0V	_	4	10	_	10	_	10	pF	

Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

Operating Characteristics (@T_A = +25°C, unless otherwise specified.)

Parameter		Test Conditions	V _{CC} = 5V Typ	Unit
C _{pd}	Power dissipation capacitance	f = 1 MHz all outputs switching-no load	43	pF

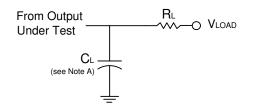


Switching Characteristics

Symbol /	Dime	To at Oanditions	V		Γ _A = +25°0	C	-40°C to	o +85°C	-40°C to) +125°C	11	
Parameter	Pins	Test Conditions	Vcc	Min	Тур	Max	Min	Max	Min	Max	Unit	
fMAX			2.0V	9	30	-	4.8	-	4	-		
Maximum	SHCP or Figure 1	SHCP or	Figure 1	4.5V	30	91	-	24	_	20	-	MHz
Frequency	3105		6.0V	35	108	-	28	_	24	-		
	SHCP		2.0V	75	17	-	95	-	110	-		
	HIGH or	Figure 1	4.5V	15	6	-	19	-	22	-		
	LOW		6.0V	13	5	-	16	-	19	-		
	STCP		2.0V	75	11	-	95	-	110	-		
t _W Dules Width	HIGH or	Figure 1	4.5V	15	4	-	19	_	22	_	ns	
Pulse Width	LOW		6.0V	13	3	-	16	_	19	_		
			2.0V	75	17	-	95	_	110	_		
	MR LOW	Figure 1	4.5V	15	6	-	19	_	22	_		
			6.0V	13	5	-	16	_	19	_		
			2.0V	50	11	-	65	_	75	_		
	DS to SHCP	Figure 1	4.5V	10	4	_	13	_	15	_	ns	
tsu	SHUP		6.0V	9	3	_	11	_	13	_		
Set-up Time			2.0V	75	22	_	95	_	110	_		
	SHCP tp STCP	Figure 1	4.5V	15	8	-	19	_	22	_	ns	
	510P	_	6.0V	13	7	_	16	_	19	_		
				2.0V	3	-6	_	3	_	3	_	
t _H	DS to SHCP	Figure 1	4.5V	3	-2	_	3	_	3	_	ns	
Hold Time	SHUP	_	6.0V	3	-2	_	3	_	3	_	-	
			2.0V	50	-19	-	65	_	75	_	ns	
t _{REC}	MR to	Figure 1	4.5V	10	-7	-	13	_	15	_		
Recovery Time	SHCP		6.0V	9	-6	-	11	_	13	_		
			2.0V	-	52	160	_	200	_	240		
	SHCP toQ7S	Figure 1	4.5V	-	19	32	_	40	_	48	ns	
t _{PD}	100/3	C _L =50pF	6.0V	-	15	27	-	34	_	41		
Propagation Delay			2.0V	-	55	175	-	220	_	265		
Delay	STCP to Qn	Figure 1	4.5V	-	20	35	_	44	_	53	ns	
	QII	C _L =50pF	6.0V	-	16	30	-	37	_	45		
t _{PHL}			2.0V	-	47	175	-	220	_	265		
Propagation	MR toQ7S	Figure 1	4.5V	-	17	35	-	44	_	53	ns	
Delay		C _L =50pF	6.0V	-	14	30	-	37	-	45		
			2.0V	-	47	150	-	190	_	225		
t _{EN}	OE to Qn	Figure 1	4.5V	-	17	30	-	38	_	45	ns	
Enable Time		CL=50pF	6.0V	-	14	26	-	33	_	38		
		<u> </u>	2.0V	-	41	150	-	190	_	225		
t _{DIS}	OE to Qn	Figure 1	4.5V	-	15	30	-	38	_	45	ns	
Disable Time		C _L =50pF	6.0V	_	12	26	_	33	_	38		

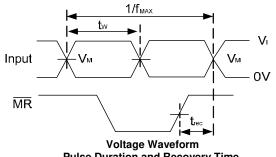


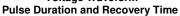
Parameter Measurement Information

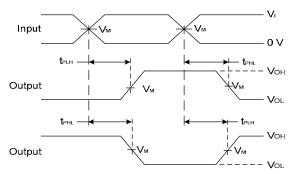


TEST	Vload
t _{PLH} /t _{PHL}	Open
t _{PLZ} /t _{PZL}	Vcc
t _{PHZ} /t _{PZH}	GND

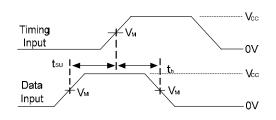
V _{cc}	Inp	outs	V _M	C∟
	VI	t _r /t _f		
2.0V	V _{CC}	6ns	V _{CC} /2	50pF
4.5V	V _{CC}	6ns	V _{CC} /2	50pF
6.0V	V _{CC}	6ns	V _{CC} /2	50pF



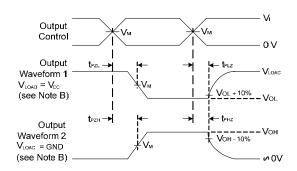


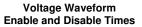


Voltage Waveform **Propagation Delay Times** Inverting and Non Inverting Outputs



Voltage Waveform Set-up and Hold Times





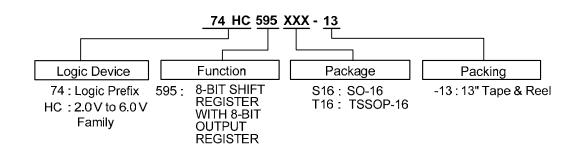
Notes: A. Includes test lead and test apparatus capacitance.

- B. Output Waveform 1 depends on the internal Q_N node being low and behaves in this manner based on OE pin. Output Waveform 2 depends on the internal Q_N node being high and behaves in this manner based on OE pin. C. All pulses are supplied at pulse repetition rate \leq 10MHz
- D. Inputs are measured separately one transition per measurement
- E. tPLH and tPHL are the same as tPD

Figure 1. Load Circuit and Voltage Waveforms



Ordering Information

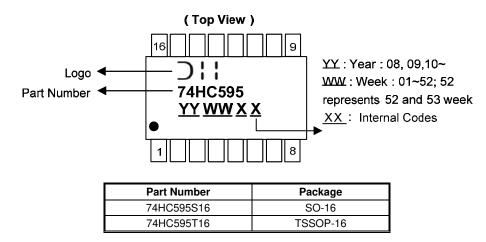


Part Number	Package Code Packaging		7" Tape and	Reel (Note 6)
Fait Nulliber	Fackage Coue	Packaging	Quantity	Part Number Suffix
74HC595S16-13	S16	SO-16	2500/Tape & Reel	-13
74HC595T16-13	T16	TSSOP-16	2500/Tape & Reel	-13

Note: 6. The taping orientation is located on our website at http://www.diodes.com/datasheets/ap02007.pdf

Marking Information

(1) SO-16, TSSOP16

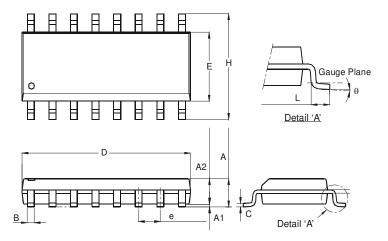




Package Outline Dimensions (All dimensions in mm.)

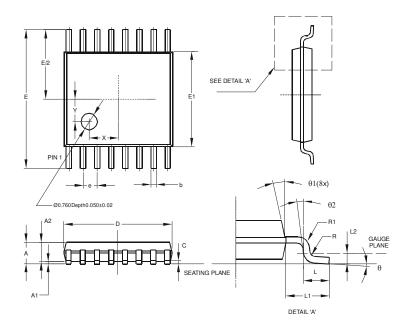
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.

Package Type: SO-16



	SO-16							
Dim	Dim Min Max							
Α	1.40	1.75						
A1	0.10	0.25						
A2	1.30	1.50						
В	0.33	0.51						
С	0.19	0.25						
D	9.80	10.00						
Е	3.80	4.00						
е	1.27	Тур						
н	5.80	6.20						
L	0.38	1.27						
θ	θ 0° 8°							
All D	imension	s in mm						

Package Type: TSSOP-16



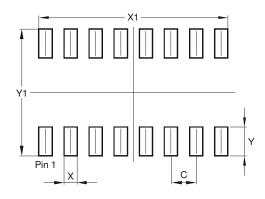
	TSS	OP-16					
Dim	Min Max Typ						
Α	-	1.08	-				
A 1	0.05	0.15	-				
A2	0.80	0.93	-				
b	0.19	0.30	-				
С	0.09	0.20	-				
D	4.90	5.10	-				
Е	6	6.40 BS	SC				
E1	4.30	4.50	-				
е	0	.65 BS	SC				
L	0.45	0.75	-				
L1	1	.00 R	EF				
L2	0	.25 BS	SC				
R	0.09	-	-				
R1	0.09	-	-				
Х	1	1	1.350				
Y	-	-	1.050				
θ	0°	8°	-				
θ1	5°	15°	-				
θ2	0°	-	-				
All D	Dimen	sions	in mm				



Suggested Pad Layout

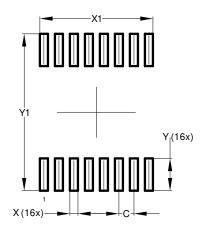
Please see AP02001 at http://www.diodes.com/datasheets/ap02001.pdf for the latest version.

Package Type: SO-16



Dimensions	Value (in mm)
С	1.270
Х	0.670
X1	9.560
Y	1.450
Y1	6.400

Package Type: TSSOP-16



Dimensions	Value (in mm)
С	0.650
Х	0.350
X1	4.900
Y	1.400
Y1	6.800



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